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Interactive Relationships between Sex-Related Alcohol Expectancies and Delay Discounting on Risky Sex

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Abstract

Background—Sex-related alcohol expectancies reflect the degree to which a person believes alcohol will affect her or his sexual behavior. Sex-related alcohol expectancies have been found to be predictors of drinking in sexual situations and engagement in risky sexual behavior after drinking. However, less is known about individual characteristics that may moderate these associations. Building upon recent evidence that steep delay discounting is associated with alcohol-related sexual risk taking, this study aimed to test the hypothesis that the associations between sex-related alcohol expectancies and alcohol-related sexual risk taking would be stronger among individuals who discount delayed rewards more steeply.

Methods—The current sample comprised 126 Emergency Department patients (M_{age}=27.37; 55% male) who reported high-risk alcohol use and sexual behavior during the past three months. Sex-related alcohol expectancies were assessed in three behavioral domains: increased riskiness, decreased nervousness, and enhanced sexuality.

Results—All three expectancy domains were associated with quantity and frequency of alcohol use, as well as percentage of alcohol-related condomless sex. Delay discounting moderated two of these relationships, such that the associations between expectancies for alcohol-induced sexual risk taking and the enhancement of sexuality and percentage of alcohol-related sexual risk-taking were significantly stronger in individuals who exhibited steeper delay discounting.

Conclusions—These findings suggest that individuals who both discount delayed rewards more steeply and hold strong sex-related alcohol expectancies are a particularly high-risk population. Such individuals may benefit from a combination of novel preventive strategies targeting sex-related alcohol expectancies and impulsive decision making.

Keywords

sex-related alcohol expectancies; delay discounting; sexual risk taking

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Introduction

Risky sexual behavior (e.g., condomless sex with non-steady partners) continues to be the predominant mode of HIV transmission in the United States (Centers for Disease Control and Prevention [CDC], 2013a). With other sexually transmitted diseases (STDs) also reaching epidemic levels (CDC, 2013b), prevention of risky sexual behavior is a national public health priority. Alcohol use is generally accepted as one of the most reliable predictors of risky sexual behavior (George & Stoner, 2000; Shuper et al., 2009). There are increasing efforts to examine individual and contextual factors that shape the association between alcohol and sexual risk behavior, in order to better understand factors that influence decisions to drink in sexual situations and decisions to engage in risky sex while intoxicated. Alcohol expectancies are particularly relevant, due to their potential to influence decisions about how often and how much to drink, and the consequences of alcohol consumption (Goldman et al., 2006).

Alcohol expectancies are defined as the anticipated effects of drinking alcohol (George et al., 2000), and typically structured as if-then statements (e.g., if I drink alcohol, then I will feel more relaxed; Goldman et al., 1999). Informed by social learning theory (Bandura, 1977; Rotter et al., 1972), alcohol outcome expectancy theory posits that alcohol expectancies are the product of direct and indirect experience with alcohol (Jones et al., 2001). The degree to which a person expects the consequences of drinking to be positive or negative putatively increases or decreases the likelihood of drinking, respectively. Furthermore, the extent to which an individual expects a certain consequence to occur as a result of drinking is theorized to predict the likelihood of that consequence actually taking place after drinking. Human laboratory studies have demonstrated that, even in the absence of alcohol consumption, expectancies can influence behavior (see Hull & Bond, 1986; George et al., 2012, for review).

Sex-related alcohol expectancies are defined as one’s beliefs about the effects of alcohol on her or his sexual behavior, attitudes, and emotions in sexual situations (Dermen & Cooper, 1994a), including expectations of sexual enhancement, decreased nervousness, and increased sexual riskiness (Leigh, 1990; Dermen & Cooper, 1994a). Compared to the extant body of literature on general alcohol expectancies, a relatively small number of published studies have examined the associations between these distinct expectancies and alcohol consumption. These studies have demonstrated that heavy drinkers are more likely to endorse beliefs that alcohol enhances sexual pleasure and performance, increases sexual riskiness, and decreases nervousness in sexual situations (Leigh, 1990), and that measures of sex-specific expectancies outperform general alcohol expectancy measures (e.g., beliefs regarding disinhibition, tension reduction) in strength of association with alcohol use in sexual situations (Dermen & Cooper, 1994b).

Sex-related alcohol expectancies are also associated with risky sexual behavior in the context of alcohol use. For example, Dermen and colleagues (1998) found that increased sexual riskiness expectancies were associated with higher levels of sexual risk taking, and that the association between alcohol use and engagement in risky sex was stronger among adolescents who believe that alcohol increases sexual riskiness. Similarly, Bryan and

colleagues (2007) found that the association between alcohol use and engagement in condomless sex was stronger among adolescents who reported higher sexual enhancement expectancies, and also found that increased riskiness expectancies predicted engagement in condomless sex at 6-month follow-up. These findings from non-clinical adolescent samples are consistent with alcohol outcome expectancy theory, in that individuals who believe that alcohol use increases sexual riskiness engage in more sexual risk taking when drinking.

Consistent findings have been observed among clinical populations. In a sample of adults with severe and persistent mental illness, Weinhardt and colleagues (2002) found that sex-related alcohol expectancies for enhanced sex, increased riskiness, and decreased nervousness were positively associated with alcohol consumption before sex and with engagement in risky sex when drinking. Kalichman and colleagues (2003) found that the expectancy that alcohol would enhance sex was positively associated with both alcohol use and engagement in condomless sex among men receiving services at an STD clinic.

In summary, this relatively small body of research illustrates a pattern of findings in which sex-related alcohol expectancies are related to drinking in sexual situations. More specifically, expectancies that alcohol increases riskiness and enhances pleasure are related to engagement in sexual HIV/STD risk behaviors when drinking. The objective of the current study was two-fold. First, the study sought to examine the association between sex-related alcohol expectancies and engagement in risky sex while intoxicated within a sample of high risk patients presenting for treatment in an Emergency Department (ED) setting. These associations are particularly relevant to this patient population, due to the increased rate of alcohol consumption (Cherpitel, 1999; Cherpitel & Ye, 2012) and heightened HIV/STD risk factors among ED patients (Claus et al., 2011; Mastroleo et al, 2015; Zetola et al., 2008).

Second, the study sought to investigate delay discounting as a moderator of the association between expectancies and alcohol-related sexual risk behavior. While sex-related alcohol expectancies have been investigated as mechanisms of action that facilitate alcohol-related sexual risk taking, there has been little to no investigation of individual characteristics – beyond gender – that potentially moderate the association between expectancies and engagement in risky sex. Delay discounting is an index of how much a person devalues (or discounts) an outcome – traditionally a monetary reward – as a function of its delay to receipt (Bickel & Marsh, 2001; Madden & Bickel, 2010). A greater tendency to discount delayed rewards (i.e., steep delay discounting) is often referred to as a behavioral economic index of impulsivity (Bickel et al., 1999; Baker et al., 2003; Green et al., 1994; MacKillop et al., 2011; Madden & Bickel, 2010). However, associations between performance on delay discounting tasks and survey-based assessment of trait level impulsivity are often weak or null (MacKillop et al., 2014; Reynolds et al., 2006), suggesting that delay discounting is not synonymous with impulsivity as indexed by traditional personality measures, but instead may represent one facet in a multi-faceted model of impulsivity comprising distinct cognitive and behavioral elements (de Wit, 2009; Caswell, Bond et al., 2015; Caswell, Celio, et al., 2015; Reynolds et al., 2006). Equally plausible is the notion that delay discounting should not be described as impulsivity at all, but instead reflects a unique

decision-making process that may be applied to better understand psychological concepts such as self-control and risk taking (Green & Myerson, 2004).

Steep delay discounting has consistently been associated with alcohol and other drug misuse (see MacKillop et al., 2011 for review), with increasing evidence that delay discounting is not simply independently relevant to health behavior, but moderates the relationship between other variables (e.g., Epstein et al., 2014; Rollin et al., 2010). There is also evidence that domain-general delay discounting (i.e., for monetary rewards) is associated with sex risk behaviors (Chesson et al., 2006). Furthermore, several studies have shown that sexual activity is discounted much like other commodities (Lawyer et al., 2010; Johnson & Bruner, 2012; Jarmolowicz et al., 2013; Jarmolowicz et al., 2015), and that sexual discounting tasks generally outperform traditional monetary discounting tasks in terms of strength of association with clinically-relevant sexual variables (Johnson & Bruner, 2012; Lawyer & Schoepflin, 2013; Johnson et al., 2015). Our recent findings are consistent with this literature in that we observed a non-significant association between monetary delay discounting and non-steady condomless sex in general (MacKillop et al., 2015). However, we observed that monetary delay discounting was significantly associated with engagement in non-steady condomless sex when the sexual activity occurred in the context of alcohol use, which suggests that a person's relative level of discounting moderates aspects of intoxication that in turn affect risky sexual behavior. In light of these findings, we hypothesized that sex-related alcohol expectancies would differentially predict engagement in sexual HIV/STD risk behavior with non-steady partners in the context of alcohol use based on the degree to which individuals discount delayed rewards.

Materials and Methods

Participants

The current study analyzed baseline data collected within a randomized clinical trial of a brief intervention targeting alcohol and sex-risk behaviors among patients seeking treatment in the ED of two Rhode Island community hospitals. The target population comprised English-speaking patients ages 18 to 65. Potential participants were screened for heavy/problem alcohol use and risky sexual behaviors. Inclusion criteria for the trial were: (1) meeting the criterion for hazardous drinking (total score ≥ 8 for males; ≥ 6 for females) on the Alcohol Use Disorders Identification Test (AUDIT; Babor et al., 2001) or endorsing at least one episode of binge drinking (≥5 drinks for males; ≥ 4 drinks for females) in the past three months; and (2) engaging in one or more of the following sex-risk behaviors in the past three months: condomless sex; consuming alcohol/other drugs prior to or during sex; or sexual activity with a non-steady partner, multiple partners, or with a steady partner where infidelity is known or suspected. Patients in a mutually monogamous relationship for longer than six months, those receiving treatment for a self-inflicted injury/suicide attempt, and those in police custody were excluded.

Recruitment was conducted from May 2011 to October 2013. The measure of delay discounting employed in this study was introduced into the protocol approximately nine months after the onset of recruitment. Subsequently, 231 participants were available for this study. The current study focuses exclusively on non-steady partner sex, as prior studies have

found a stronger association between alcohol use and risky sex among non-steady versus steady partners (Vanable et al., 2004; Brown & Vanable, 2007). One-hundred forty-two participants endorsed sexual activity with a non-steady partner in the past three months. Of these, 16 participants (11%) had missing data on the included measures (due to participants electing not to answer items), resulting in a final sample of 126 participants.

Procedure

All procedures were approved by the appropriate Institutional Review Boards. Project staff worked in the EDs to identify eligible patients and explain the study. Screening took place with the permission of medical staff. A mental status exam was conducted and a breathalyzer was administered to ensure patients were able to provide informed consent. After the informed consent process, participants completed an assessment battery that took approximately 45–60 minutes. All measures were completed during, or within the two weeks following, the patient's ED visit. Participants were compensated $50 for baseline participation.

Measures

Screening Measures—The AUDIT was administered as the primary screening assessment of heavy/problematic alcohol use. This questionnaire consists of 10-items, each scored on a 4-point scale, with a cumulative score range of 0–40. A score of eight or higher reflects hazardous alcohol use (Conigrave et al., 1995), but more recent research suggests a more appropriate cut point of six or higher for females (Reinert & Allen, 2002). Inclusion criteria related to sexual risk-taking behaviors were assessed using a brief questionnaire comprising items that have been successfully used to identify individuals at risk for HIV/STD transmission in previous research (Kalichman et al., 1998; Millstein & Moscicki, 1995). The first item assessed the patient's total number of sexual partners (vaginal or anal sexual intercourse) over the past three months. If the participant indicated having only one partner, the second question assessed the length of the relationship. Three subsequent items evaluated sex-risk behaviors over the past three months, including frequency of condomless sexual intercourse (vaginal or anal), frequency of consuming alcohol before or during sex, and frequency of using any drug before or during sex.

Primary Assessment—Demographic data were collected via self-report. This included questions pertaining to the participant's age, gender, race, education, and annual household income. Dichotomous coding was applied to race (0=White, 1=Other). Education and income were coded categorically, with higher scores denoting more education and higher income. A Timeline Follow Back interview (TLFB; Sobell & Sobell, 2003; Sobell et al., 1986) was used to assess alcohol use over the past 30-days, from which indices of frequency (number of drinking days) and quantity (average drinks per drinking day) were derived.

Sexual activity during the past three months was assessed using a structured interview developed for this study (available upon request). Participants were asked the number of steady and non-steady sexual partners over the past three months. Steady partners were defined as "a romantic, committed relationship for at least three months (meaning that you can only have one steady partner during the last three months)," and non-steady partners as

"A non-committed relationship, in which you have had sex one or more times, and you have the understanding that your partner may have sex with other people." These categories were not mutually exclusive; a participant could have one steady partner and one or more non-steady partners.

For each partner type, follow-up questions assessed the number of times the participant had sex, the number of times they had condomless sex, and the number of times they had condomless sex under the influence of alcohol. The current study focuses exclusively on non-steady partner sex and on condomless sex in the context of alcohol use – in contrast to all condomless sex – as this behavior is theoretically linked to sex-related alcohol expectancies. In this context, two dependent measures of alcohol-related sexual risk taking were examined: 1) *frequency* of alcohol-related condomless sex; and 2) *percentage* of alcohol-related condomless sex, which was calculated by dividing the number of non-steady sex events that were condomless and involved alcohol by the total number of non-steady sex events. The frequency-based measure provides an index of the number of potential alcohol-related HIV/STD exposures and/or transmissions, while the percentage-based measure provides an index of alcohol-related sexual risk taking relative to the individual's own level of non-steady partner sexual activity. A higher score on the percentage-based measure suggests that alcohol-related condomless sex represents a larger percentage of the individual's non-steady partner sexual activity.

Sex-Related Alcohol Expectancies were assessed using Leigh's 13-item questionnaire (Leigh, 1990). This measure assesses expectancies across three domains: 1) whether alcohol increases sexual risk taking ("Increased Riskiness"); 2) whether alcohol enhances sexual performance and pleasure ("Enhanced Sexuality"); and 3) whether alcohol decreases sex-related nervousness ("Decreased Nervousness"). Each item assessed the degree to which the individual believes that alcohol produces the specific sex-related effect (e.g., "feel less nervous about sex"), from 0 "not at all" to 3 "very much." Domain scores were computed by dividing the total score within each domain by the number of items within that domain, with higher scores denoting stronger belief of sex-related alcohol expectancies.

Delay discounting was assessed using the Monetary Choice Questionnaire (MCQ; Kirby et al., 1999), a widely-used 27-item measure of monetary intertemporal choice preferences. For each item, individuals were presented with two choices in the following form: "*Would you prefer 55 dollars today or 75 dollars in 61 days?*" Participants in this study made choices for hypothetical monetary rewards, as previous studies have found close correspondence between hypothetical and actual choices in delay discounting paradigms (Johnson & Bickel, 2002; Lagorio & Madden, 2005; Madden et al., 2003; Madden et al., 2004). Across all items, the smaller-sooner choice reflects impulsive decision making independent of reward magnitude (i.e., small, medium, and large monetary values) and duration of delay. The participant's pattern of responding is used to infer delay discounting functions (k values) for small, medium, and large reward magnitudes, as well as an overall k value that reflects discounting across all reward magnitudes. These k values range from .00016–.25, with larger values reflecting steeper devaluation of delayed rewards (i.e., more impulsive decision making). The MCQ also allows for evaluation of the consistency of the inferred k value with each participant's overall responding. High consistency scores indicate

systematic non-random preferences that suggest that the participant was attentive and applied adequate effort while completing this measure.

Statistical Analyses

Descriptive statistics and histograms were employed to examine each variable of interest and determine whether it was appropriate for parametric analyses, with transformations used if appropriate. . Next, bivariate correlations were employed to examine the direct associations among variables of interest, and to identify statistically significant covariates for inclusion in subsequent analyses. Age, gender, race, education, and annual household income were explored as a priori covariates. Given the emphasis on co-occurring alcohol use and risky sex, alcohol use frequency (i.e., number of drinking days during the past month) and quantity (i.e., number of drinks per drinking day in the past month) were also included as a priori covariates. Finally, a series of hierarchical regression analyses were employed to examine the main and interactive effects of sex-related alcohol expectancies and delay discounting on both frequency and percentage of alcohol-related condomless sex after accounting for relevant covariates. Each of the three domains of sex-related alcohol expectancies (i.e., increased riskiness, enhanced sexuality, and decreased nervousness) was assessed in a separate regression analysis. The planned structure of each model was as follows: statistically relevant covariates were entered in the first step, sex-related alcohol expectancies, delay discounting, and the interaction between these terms was entered in the second step. Expectancy domain scores and the overall *k* value derived from the MCQ were centered before creating interaction terms so that main and interactive effects could be tested simultaneously (Aiken & West, 1991; Jaccard & Turrisi, 2003). Residual plots were examined to assess for model violations (nonlinearity, heteroscedasticity, etc.). Throughout all analyses, $p < .05$ was interpreted as statistically significant.

Results

Demographics and Summary Statistics

The sample was predominantly male (55%) and White (91%) with an average age of 27.37 years (*SD* = 8.14; range: 18–60). Regarding education, 7% of participants reported completion of a four-year degree, 10% reported completion of a two-year or technical degree, 32% reported partial college, and approximately half of the sample (51%) reported having a high school diploma or less education. The majority (62%) of participants reported an annual household income less than $30,000.

The average AUDIT score at screening was 11.81 (*SD* = 8.23; range: 1–36). Using gender-specific thresholds (i.e., ≥6 for women; ≥8 for men), 73% of the sample were hazardous drinkers. Based on the 30-day TLFB interview, the average frequency of drinking was 10.11 days (*SD* = 8.33; range: 1–30), with an average of 7.44 drinks per drinking day (*SD* = 5.09; range: 1–34). On average, participants reported approximately 20 sexual events with non-steady partners over the past three months (*M* = 19.51; *SD* = 33.73; range: 1–270), and approximately 15 of these events involved condomless sex (*M* = 14.87; *SD* = 33.60; range: 0–270). The average frequency of alcohol-related condomless sex was approximately 10 events over the past three months (*M* = 9.79; *SD* = 30.76; range: 0–270). With regard to

percentage of alcohol-related condomless sex, the average participant engaged in alcohol-related condomless sex in approximately 37% of their sexual activity with non-steady partners (*SD* = 38.26; range: 0–100). Frequency of non-steady sex, condomless non-steady sex, and alcohol-related condomless non-steady sex events were all skewed, and were therefore log10 transformed, which substantially improved the distributions.

The degree to which participants endorsed sex-related alcohol expectancies for decreased nervousness (*M* = 1.48; *SD* = 0.85) and enhanced sexuality (*M* = 1.48; *SD* = 0.91) were nearly identical. Expectancies regarding increased sexual riskiness were slightly lower (*M* = 1.10; *SD* = 0.98). Expectancies for decreased sexual nervousness and enhanced sexuality were nearly universal, with 98% believing to some degree (i.e., domain score > 0) that alcohol decreases nervousness, and 98% believing to some degree that alcohol enhances sexuality. Expectancies for increased riskiness were endorsed less frequently, with 71% of participants believing to some degree that alcohol increases sexual riskiness.

Regarding MCQ data, participants were highly consistent in terms of their preferences (*M* = 0.98), suggesting good task effort. The small, medium, large magnitude and overall *k* values were skewed, as is common, and were therefore log10 transformed. As expected, the steepest pattern of discounting was observed for small magnitude rewards, followed by medium and large magnitude rewards, respectively. These three indices were significantly and substantially positively intercorrelated (*r*s = .67–.84). Thus, the overall *k* value was used as the primary index of delay discounting for all subsequent analyses.

Bivariate Correlation Analysis

The direct relationships among covariates and variables of interest were examined using bivariate correlation analysis (see Table 1). Age, gender, and income were not significantly associated with other variables of interest, and were excluded from subsequent analyses. White race was significantly associated (*p* = .026) with the expectancy that alcohol increases riskiness and marginally associated (*p* = .054) with the expectancy that alcohol enhances sexuality. Education was negatively correlated with the overall *k* value. Consequently, race and education were included as statistically significant covariates in subsequent analyses.

The observed correlations among the expectancy domain scores were high (*r*s = .58–.72), but show that more than 50% of the variance in each domain score was non-overlapping. As predicted, significant associations were observed between sex-related alcohol expectancies and frequency and quantity of alcohol use. Individuals who drank more frequently and reported higher drinks per drinking day endorsed stronger beliefs that alcohol decreased nervousness, enhanced sexuality, and increased sexual riskiness.

Frequency and quantity of alcohol use were both significantly positively associated with *frequency* of alcohol-related condomless sex. That is, individuals who drink more often and individuals who drink in larger quantities engage in more condomless sex while intoxicated. Furthermore, frequency and quantity of drinking were both significantly positively associated with *percentage* of alcohol-related condomless sex, in that condomless sex while intoxicated represented a higher percentage of non-steady sexual activity among individuals who drink more frequently and/or in larger quantities. Frequency and percentage of alcohol-

related condomless sex were strongly correlated; however, more than 50% of the variance in each index was non-overlapping.

Regarding sex-related alcohol expectancies, frequency of alcohol-related condomless sex was only significantly associated with the expectancy that alcohol increases sexual riskiness. In contrast, percentage of alcohol-related condomless sex was significantly positively correlated with all three expectancy domain scores. Increased riskiness produced the strongest correlation, followed by enhanced sexuality and decreased nervousness. Sex-related alcohol expectancies were not significantly correlated with total frequency of non-steady partner sex or with frequency of condomless non-steady partner sex in general, suggesting that the association between sex-related alcohol expectancies and condomless sex is specific to situations involving alcohol.

Delay Discounting as a Moderator of Sex-related Alcohol Expectancies

A series of hierarchical regression analyses were conducted to examine the main and interactive effects of sex-related alcohol expectancies and delay discounting on both frequency and percentage of alcohol-related condomless sex. Regarding *frequency* of alcohol-related condomless sex (see Table 2), the covariate model explained approximately 24% of the observed variance, $R^2 = .24$, $F(4, 121) = 9.42$, $p < .001$. Only frequency of alcohol use was significantly associated with frequency of alcohol-related condomless sex, with higher engagement observed among individuals who drink more frequently.

The main and interactive effects of sex-related alcohol expectancies and delay discounting were evaluated in the second step of each regression model. With specific regard to frequency of alcohol-related condomless sex, no significant main or interactive effects were observed when each sex-related alcohol expectancy domain score (i.e., increased riskiness, enhanced sexuality, and decreased nervousness), the overall *k* value, and the corresponding interaction variables were entered into the model.

A markedly different pattern of results was observed when examining *percentage* of alcohol-related condomless sex (see Table 3). The covariate model accounted for 28% of the variance in percentage of alcohol-related condomless sex, $R^2 = .28$, $F(4, 121) = 11.71$, $p < .001$. Only frequency of alcohol use was significantly associated with percentage of alcohol-related condomless sex. After controlling for relevant covariates, the main effects of the increased riskiness domain score and delay discounting were both statistically significant. Furthermore, the interaction between these terms was significant indicating that the effect of expectancies on percentage of alcohol-related condomless sex was stronger at higher levels of delay discounting. The complete regression model accounted for 37% of the variance in percentage of alcohol-related condomless sex, $R^2 = .37$, $F(3, 118) = 5.92$, $p = .001$. For graphing purposes, a tertile split was employed to categorize participants based on their overall *k* value (see Figure 1). Group-level analyses (i.e., Chi Square and ANOVAs) showed that these three groups were comparable on all relevant demographics and variables of interest other than the overall *k* value.

A similar pattern of results was observed regarding expectancies that alcohol enhances sexuality. After controlling for covariates, the main effect of the enhanced sexuality domain

score was not significant, but delay discounting and the interaction between these terms was significant. The complete regression model accounted for 34% of the variance in percentage of alcohol-related condomless sex, $R^2 = .34$, $F(3, 118) = 3.58$, $p = .016$. The observed interaction effect is illustrated in Figure 2.

Finally, when the decreased nervousness domain score, delay discounting, and the corresponding interaction variable were entered, the complete model accounted for 32% of the variance in percentage of alcohol-related condomless sex, $R^2 = .32$, $F(3, 118) = 2.06$, $p = .11$. While the main effect of delay discounting was significant, the main effect of the decreased nervousness domain score and the interaction between these terms were both non-significant.

Discussion

The goals of the current study were twofold, to examine the relationship between sex-related alcohol expectancies and alcohol-related sexual risk taking among ED patients, and to explore whether these relationships were moderated by delay discounting. Consistent with previous findings, the current results obtained within a high risk sample of ED patients demonstrate that sex-related alcohol expectancies are associated with quantity and frequency of alcohol use. In addition, sex-related alcohol expectancies – particularly those related to increased riskiness – were associated with both frequency and percentage of alcohol-related condomless sex. Furthermore, we found support for the hypothesis that delay discounting plays an important role in the relationship between expectancies and the percentage of non-steady sex events that involved alcohol-related condomless sex. The associations between percentage of alcohol-related condomless sex and both expectancies for alcohol-induced risk taking and the enhancement of sexuality were significantly stronger in individuals who exhibited steeper delay discounting. Indeed, the current results suggest expectancies related to increased riskiness and enhanced sexuality are associated with alcohol-related condomless sex, but only among individuals who discount delayed rewards more steeply.

The same pattern of findings was not observed for the second outcome - *frequency* of alcohol-related unprotected sex. The results of the hierarchical regression analyses showed that the significant associations observed between frequency of alcohol-related condomless sex and both delay discounting and increased riskiness expectancy were no longer significant after controlling for frequency of alcohol use. The difference in the observed findings is likely due to the fact that the percentage-based index of alcohol-related condomless non-steady sex accounts for one's overall level of engagement in non-steady partner sexual activity, which varied considerably across individuals within this sample. It is important to note that an individual who reports 20 incidents of alcohol-related condomless sex out of 40 non-steady sexual encounters (i.e., 50%) is at greater risk of HIV/STD exposure and/or transmission than an individual who engages in 5 incidents of alcohol-related condomless sex out of 5 non-steady sexual encounters (i.e., 100%) based solely on rate of potential exposure.

The current findings demonstrate that while individuals with higher expectancies for alcohol-induced risk taking who discount delayed rewards more steeply do not engage in

alcohol-related condomless sex *more frequently* than others, they do report that alcohol-related condomless sex represents a greater *percentage* of their non-steady partner sexual activity. In other words, these individuals have a higher likelihood of engaging in alcohol-related sexual risk behavior relative to their own level of non-steady partner sexual activity. The current findings are in line with alcohol expectancy theory as applied to risky sexual behavior. The extent to which an individual expects a certain consequence to occur as a result of drinking is not associated with sexual activity in general (e.g., total non-steady partner sexual activity), which largely influences the frequency of alcohol-related condomless sex with non-steady partners. However, sex-related alcohol expectancies are associated with frequency and quantity of alcohol use, and individuals with stronger expectancies that alcohol increases sexual risk taking report that alcohol-related condomless sex represents a higher percentage of their non-steady partner sexual activity.

This study provides a novel perspective on the conditional role of expectancies in alcohol-related sexual risk taking. The findings suggest that although expectancies may generally be related to sexual risk taking in the context of alcohol use, the most potent relationship between expectancies and sexual risk taking is evident when it coincides with a general orientation toward immediate rewards. In other words, individuals who sharply discount future rewards in favor of immediate gratification appear to be particularly prone to act on sex-related expectancies.

These findings also suggest the converse is true. A robust capability to delay gratification may serve as a protective factor against high-risk alcohol expectancies. These findings require replication and should be judged in the context of both strengths and weaknesses. Clear strengths of the study include the use of a community hospital high-risk ED sample, a focus on high-risk behavior (i.e., condomless sex with non-steady partners only), and the systematic consideration of relevant covariates. However, it should be noted that the study was cross-sectional in nature which precludes making clear inferences about causality. ED patients differ from the general population on important delay-discounting-related characteristics (e.g., income/SES) and on rates of heavy drinking and risky sexual behavior, thus it is possible that the results observed in this study may not generalize to the general population. In addition, alternative assessment strategies may have yielded different outcomes. For example, the sexual behavior assessment employed in this study did not allow us to distinguish between vaginal and anal sexual activity, limiting our ability to examine the stated hypotheses in relation condomless anal sex, which has the highest risk of transmission of HIV and other STDs (CDC, 2013a). Also, there is some debate about the optimal measures of sex-related alcohol expectancies (Dermen & Cooper, 1994a), which cannot be addressed in this study.

Similarly, the delay discounting measure used financial rewards, not sex-related rewards, which have consistently been shown to outperform monetary discounting tasks in terms of strength of association with clinically relevant sexual outcomes (Johnson & Bruner, 2012; Johnson et al., 2015; Lawyer & Schoepflin, 2013). Our recent findings suggest that monetary discounting is more strongly associated with non-steady condomless sex specifically when the sexual activity occurs in the context of alcohol use (MacKillop et al., 2015). When combined with recent findings that alcohol-dependent individuals discount

sexual activity more steeply than controls (Jarmolowicz et al., 2013), a logical next step would be to examine the associations between sexual delay discounting and alcohol-related risky sex (as compared to risky sex in general), with emphasis on high-risk drinkers.

These considerations notwithstanding, the current study provides further evidence of the importance of sex-related alcohol expectancies in relation to sexual HIV/STD risk behavior and reveals for the first time a contingent relationship between expectancies and delay discounting. That the study used data gathered within a general patient population underscores the importance of considering such risk factors when developing and testing interventions for heavy drinking and sexual risk taking.

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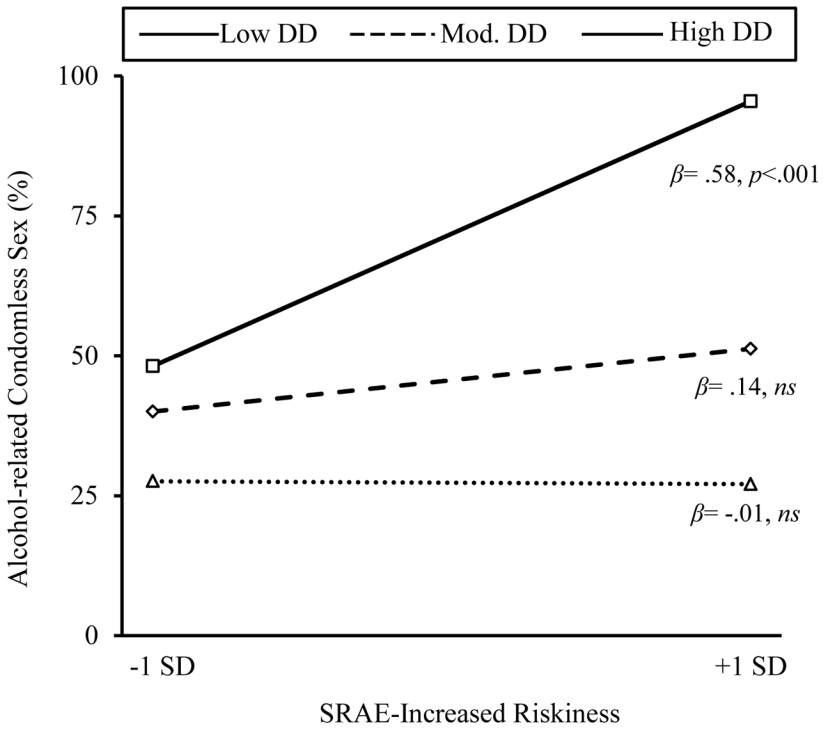

Figure 1.

Line graphs depicting the significant interaction between the sex-related alcohol expectancy – increased riskiness domain score and delay discounting. The dependent variable reflects the percentage of non-steady partner sexual activity that is condomless and involved alcohol. For the purpose of graphing, a tertile split was applied to the continuous overall *k* value, resulting in three groups: Low Delay Discounting (DD; *n* = 40), Moderate DD (*n* = 46), and High DD (*n* = 40).

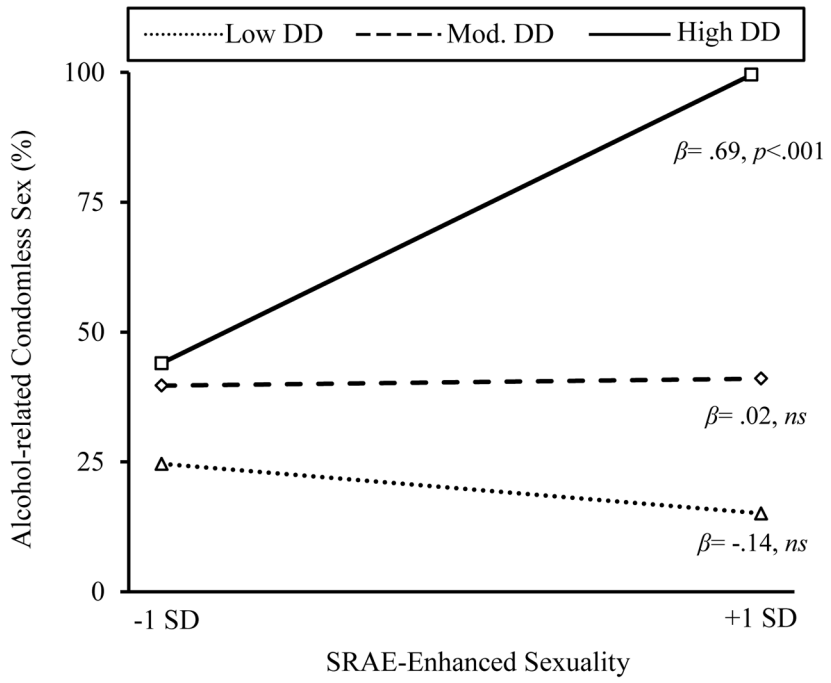

Figure 2.

Line graphs depicting the significant interaction between the sex-related alcohol expectancy – enhanced sexuality domain score and delay discounting. The dependent variable reflects the percentage of non-steady partner sexual activity that is condomless and involved alcohol. For the purpose of graphing, a tertile split was applied to the continuous overall *k* value, resulting in three groups: Low Delay Discounting (DD; *n* = 40), Moderate DD (*n* = 46), and High DD (*n* = 40).

Table 1

Bivariate Correlation Analysis Examining Associations among the Covariates and Variables of Interest

	1	2	3	4	5	6	7	8	9	10	11
1. Race [a]	---										
2. Education [b]	.17	---									
3. Alcohol Use – Frequency [c]	−.13	.09	---								
4. Alcohol Use – Quantity [d]	−.01	−.23**	.27**	---							
5. SRAE – ES [e]	−.17	−.03	.29**	.27**	---						
6. SRAE – DN [f]	−.07	.07	.20*	.29**	.72**	---					
7. SRAE – IR [g]	−.20*	−.08	.17	.28**	.58**	.58**	---				
8. Delay Discounting [h]	−.06	−.19*	.17	.17	.06	−.01	.10	---			
9. Frequency of Non-steady Partner Sex	−.08	−.13	.17	.13	−.04	−.13	−.05	.13	---		
10. Frequency of Condomless Non-steady Sex	.02	−.17	.24**	.17	.08	−.05	.11	.15	.76**	---	
11. Frequency of Condomless Sex & Alcohol	−.04	−.06	.46**	.25**	.16	.01	.21*	.19*	.66**	.86**	---
12. Percentage of Condomless Sex & Alcohol [i]	−.11	−.06	.50**	.28**	.30**	.19*	.35**	.26**	.09	.45**	.68**

[a] Race is a dichotomous variable (0 = White, 1 = Other).

[b] Education is a categorical variable with higher scores representing more education.

[c] Frequency of alcohol use reflects the percentage of drinking days in the past month.

[d] Quantity of alcohol use reflects the average number of drinks per drinking day (past 30 days).

[e] SRAE – ES is the for sex-related alcohol expectancies – enhanced sexuality domain score.

[f] SRAE – DN is the for sex-related alcohol expectancies – decreased nervousness domain score.

[g] SRAE – IR is the for sex-related alcohol expectancies – increased riskiness domain score.

[h] Delay discounting is indexed by the overall *k* value derived from the Monetary Choice Questionnaire, with higher scores representing steeper discounting of delayed rewards.

[i] Percentage of Condomless Sex & Alcohol = percentage of condomless non-steady sex events while intoxicated relative to all non-steady sexual activity (past 90 days).

* $p < .05$;

** $p < .01$

Table 2

Regression Analyses Examining the Main and Interactive Effects of Sex-Related Alcohol Expectancies and Delay Discounting on Frequency of Alcohol-Related Condomless Sex

Variable	*B*	*SE*	*β*	*t*
Covariate Model				
Race	0.07	0.16	.04	0.43
Education	−0.03	0.03	−.08	−0.92
Alcohol Use - Frequency	0.03	0.01	.45	5.28**
Alcohol Use - Quantity	0.01	0.01	.11	1.28
				Total R^2 = .24
Sex-Related Alcohol Expectancies – Increased Risk Taking (SRAE-IR)				
SRAE-IR	0.06	0.05	.11	1.31
Delay Discounting [a]	0.11	0.09	.10	1.22
SRAE-IR × Delay Discounting	0.05	0.08	.05	0.63
				Δ R^2 = .02; Total R^2 = .26
Sex-Related Alcohol Expectancies – Enhanced Sexuality (SRAE-ES)				
SRAE-ES	−0.001	0.05	.002	0.03
Delay Discounting	0.10	0.09	.10	1.15
SRAE-ES × Delay Discounting	0.06	0.11	.05	0.59
				Δ R^2 = .01; Total R^2 = .25
Sex-Related Alcohol Expectancies – Decreased Nervousness (SRAE-DN)				
SRAE-DN	−0.07	0.06	−.11	−1.33
Delay Discounting	0.09	0.09	.09	1.07
SRAE-DN × Delay Discounting	−0.04	0.11	−.03	−0.33
				Δ R^2 = .02; Total R^2 = .26

[a] Delay discounting is indexed by the overall *k* value derived from the Monetary Choice Questionnaire, with higher scores representing steeper discounting of delayed rewards.

* $p < .05$;

** $p < .01$

Table 3

Regression Analyses Examining the Main and Interactive Effects of Sex-Related Alcohol Expectancies and Delay Discounting on Percentage of Alcohol-Related Condomless Sex

Variable	*B*	*SE*	*β*	*t*
Covariate Model				
Race	−6.17	10.70	−.05	−0.58
Education	−1.25	1.80	−.06	−0.70
Alcohol Use - Frequency	2.10	0.38	.46	5.59**
Alcohol Use - Quantity	1.10	0.63	.15	1.76
				Total R^2 = .28
Sex-Related Alcohol Expectancies – Increased Risk Taking (SRAE-IR)				
SRAE-IR	9.41	3.05	.24	3.09**
Delay Discounting [a]	12.89	5.61	.18	2.30*
SRAE-IR × Delay Discounting	10.59	5.16	.15	2.05*
				Δ R^2 = .09; Total R^2 = .37
Sex-Related Alcohol Expectancies – Enhanced Sexuality (SRAE-ES)				
SRAE-ES	5.56	3.40	.13	1.64
Delay Discounting	11.29	5.64	.16	2.00*
SRAE-ES × Delay Discounting	13.51	6.90	.15	1.97*
				Δ R^2 = .06; Total R^2 = .34
Sex-Related Alcohol Expectancies – Decreased Nervousness (SRAE-DN)				
SRAE-DN	3.06	3.68	.07	0.83
Delay Discounting	11.62	5.75	.16	2.02*
SRAE-DN × Delay Discounting	8.91	7.18	.10	1.24
				Δ R^2 = .04; Total R^2 = .32

[a] Delay discounting is indexed by the overall *k* value derived from the Monetary Choice Questionnaire, with higher scores representing steeper discounting of delayed rewards.

* $p < .05$;

** $p < .01$